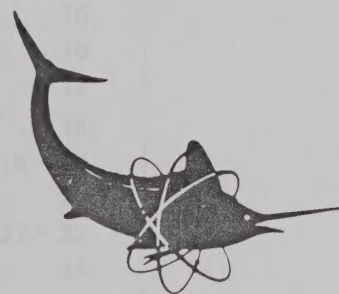
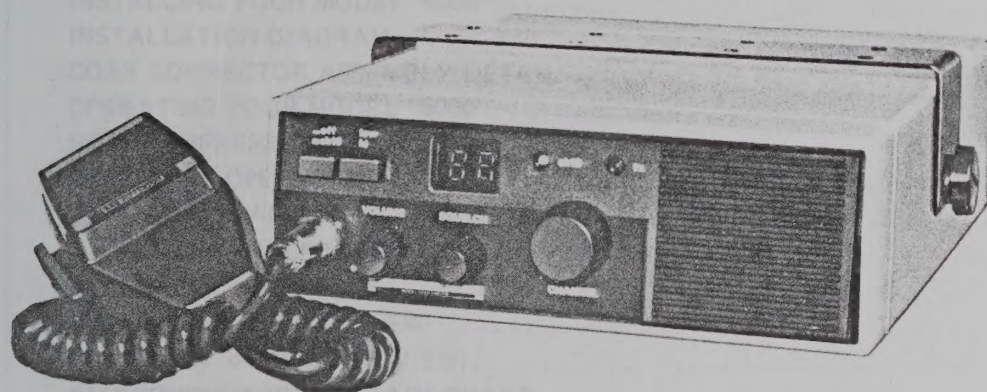


MARINE RADIO TELEPHONE MODEL 5000 VHF/FM WITH PHASE LOCK LOOP



INSTRUCTION HANDBOOK

**PRICE
FIVE DOLLARS**

≡ RAY JEFFERSON ≡

Division Of Jetronic Industries, Inc.

SPECIFICATIONS

Model 5000

Number of Channels:	45
Frequency Range:	154.25 MHz to 162.50 MHz
Channel Spacing:	25 MHz ± 5 kHz
Modulation:	100% to 100%
RF Power Characteristics:	High Power: 25 Watts Low Power: 5 Watts
Frequency Stability:	±0.005% over 10 years ±1°C to ±5°C
Antenna Impedance:	50 Ohms
Sensitivity:	Typical 10 dB
Spurious and Harmonics:	Within 40 dB of carrier
Endurance:	20,000 hours
Mean Time Between Failures:	10,000 hours

Model 5000

Number of Channels:	45
Frequency Range:	154.25 MHz to 162.50 MHz
Channel Spacing:	25 MHz ± 5 kHz
Modulation:	100% to 100%
RF Power Characteristics:	High Power: 25 Watts Low Power: 5 Watts
Frequency Stability:	±0.005% over 10 years ±1°C to ±5°C
Antenna Impedance:	50 Ohms
Sensitivity:	Typical 10 dB
Spurious and Harmonics:	Within 40 dB of carrier
Endurance:	20,000 hours
Mean Time Between Failures:	10,000 hours

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SPECIFICATIONS

SPECIFICATIONS

TRANSMITTER:

Number of Channels: 45
Frequency Range: 156.25 MHz to 157.425 MHz
Channel Spacing: 25 KHz + 5 KHz
Modulation: 16F3 for 100%
RF Power (Switchable): High Power: 25 Watts
Low Power: 1 Watt
Frequency Stability: .0005% over the range
- 20°C to +50°C
Antenna Impedance: 50 Ohms
Switching: Solid state type
Spurious and Harmonic
Emission: 60db down or greater
Microphone: Dynamic
Current Drain: High power: 5.5 A (13.6V);
Low power: 2 A
Size: 2¾" H x 9" W x 10" D
Weight: 6½ lbs.

RECEIVER:

Number of Channels: 50
Frequency Range: 156.25 MHz to 162.550 MHz
Channel Spacing: 25 KHz
Sensitivity: 0.5µV or less for - 20db quieting
Selectivity: - 70db @ 25 KHz (EIASINAD)
Frequency Stability: .0005% over the range
- 20°C to +50°C
Spurious and Image
Rejection: 70db or greater
Squelch Sensitivity: Threshold: .35µV
Tight: 1.5µV
IF Frequencies: 1st IF: 21.4 MHz
2nd IF: 455 KHz
Audio Output: 3 Watts minimum @ 10% distortion
(4 Ohm load)
Receiver Current: 1 amp maximum

RAY JEFFERSON'S MODEL "5000" VHF/FM IS
FCC TYPE ACCEPTED FOR MARINE/MOBILE
USE UNDER PART 83, FOR VOLUNTARILY
FITTED VESSELS.

NO LICENSED TECHNICIAN REQUIRED FOR
INSTALLATION PROVIDING PRETUNING IS
NOT CHANGED.

INTRODUCTION

CONGRATULATIONS . . .

on your new Ray Jefferson Model "5000".
You now own all the radio you'll ever need for US
MARINE communications.

The Model "5000" is an all solid state, compact, VHF/FM
marine radio telephone. It provides US VHF/FM channels
designated for marine use.

The unit has been scientifically designed and engineered
to operate at maximum efficiency within a marine
environment, whether installed aboard a pleasure yacht
or commercial vessel. To assure years of trouble free
service, the instructions in this manual should be followed
precisely.

The Model "5000" is primarily intended for shipboard
installation employing nominal 12 volts DC power system.

The Model "5000" has 45 channels, transmit and 50
channels, receive.

Your Model "5000" is ready for instant installation.
The set is pretuned and designed with special phase-
lock-loop switching circuitry for operation over the

entire frequency range. Specific channel frequencies are
noted in your Log Book. This book is an important
item, and should not be lost. It is needed on board
to comply with FCC regulations.

This manual has been prepared with the operator and
technician in mind. It should be carefully read prior to
installation and before performing any adjustments.

NOTE: TRANSMITTER ADJUSTMENTS ARE ONLY
PERMITTED BY AN FCC LICENSED TECHNICIAN
HOLDING A FIRST OR SECOND CLASS RADIO-
TELEPHONE LICENSE.

1980

We know you're anxious to install and begin operating your Model "5000". However, before doing so, certain procedures must be followed.

Legal operation of a marine radio telephone requires:

1. A Ship's Station License – available upon application to the Federal Communications Commission, FCC Form 506 (A copy is supplied with the radio.)
2. A Restricted Radio Operator's Permit – available upon application to your local FCC Field Office, with no examination. FCC Form 753A. (A copy is

supplied with the radio.)

3. A copy of Part 83 of the Commission Rules, available from the Superintendent of Documents, Washington, D.C. 20402. You are required to read and understand Part 83 prior to operating the radio.
4. Log Book in which you must enter a record of each transmission.
5. A frequency check by a licensed technician. This information to be entered into the Log Book and signed by the technician. (This has been done at the factory.)

[illegible]

Formal application for a Ship Station License must be made on FCC Form 506.

(NOTE: If you already hold a station license for operating a VHF/FM marine radio telephone and are simply replacing your current set with the greater capability of the Model "5000", it is not necessary to apply for a new license or to notify the FCC of any equipment change.)

So that you may legally operate your set while awaiting arrival of your FCC license, the FCC has made provisions for issuance of an interim Ship's Station License. This license will be issued if you or your agent appear in person at the nearest Field Engineering Office of the Commission

and submit your completed Form 506, together with your request for the Interim License. The Interim License will allow you to operate your radio telephone for a period of six months from date of issue.

Your Ship Radio Station License will be valid for five years from date of issue. For prompt service and processing by the FCC, Form 506 must be typewritten. Follow the instruction sheet implicitly to avoid disappointment and unnecessary delay.

APPLICATION FOR PURCHASE OF RULES

ORDER FORM

TO: Superintendent of Documents
Government Printing Office
Washington, D.C. 20402

Please enter subscription(s) to Volume IV, containing Parts 81, 83 and 15 of the Federal Communications Commission Rules and Regulations. Make checks or money orders payable to the Superintendent of Documents.

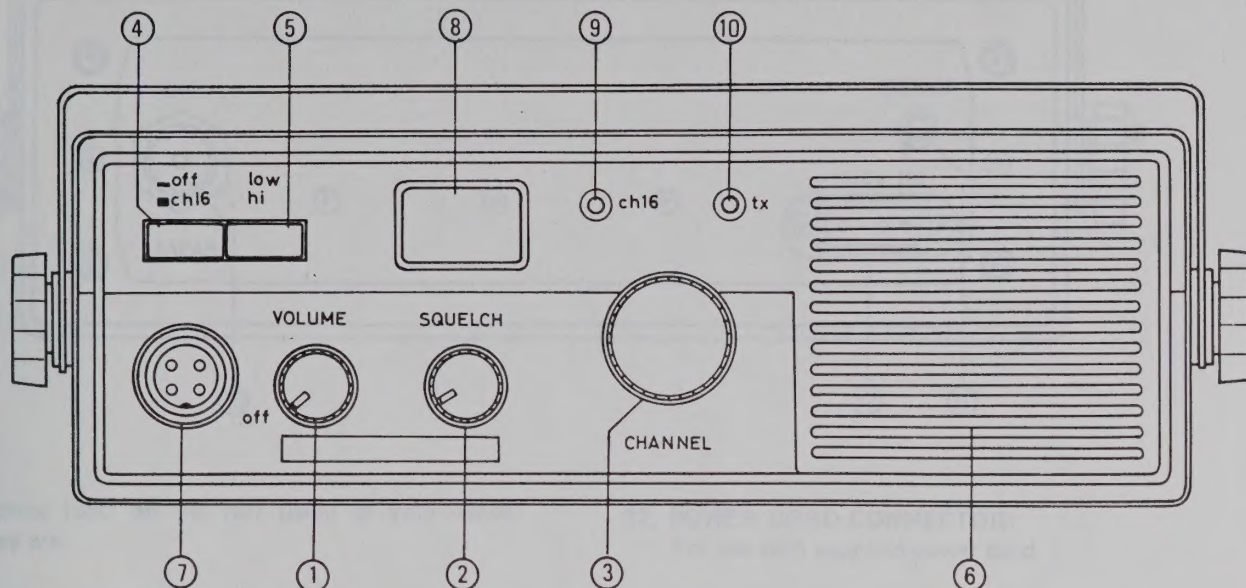
Name _____

Street Address _____

City _____ State _____ Zip Code _____

GETTING TO KNOW YOUR MODEL "5000"

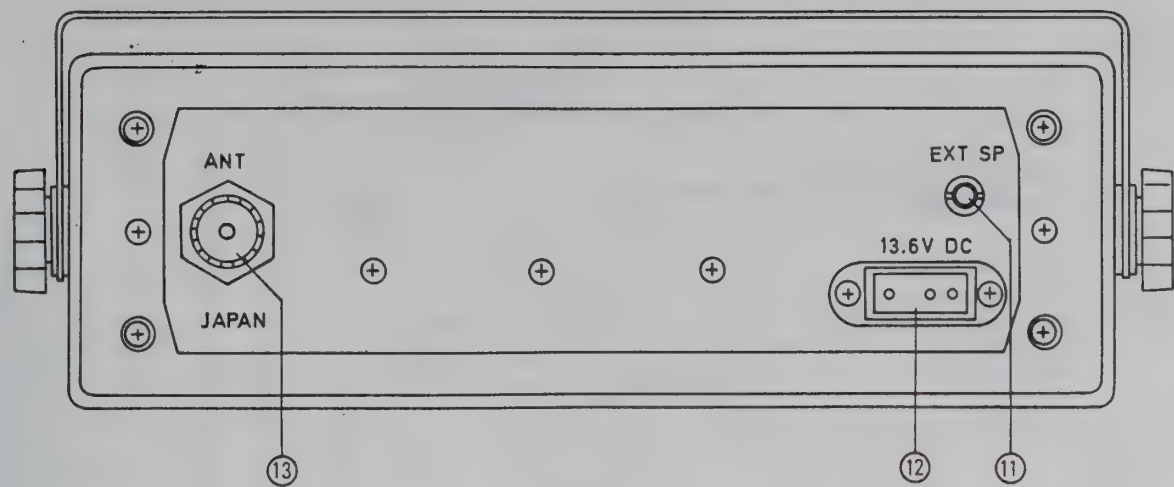
CONTROL FUNCTIONS (FRONT PANEL)



Designed for marine use, the Model "5000" permits quick and easy operation. All controls are conveniently located on the front panel. Control functions, switches and features are:

1. **ON-OFF/VOLUME CONTROL:** Applies power to the Model "5000" and adjusts desired level of sound.
2. **SQUELCH CONTROL:** When properly set, silences background noise in absence of a received signal.
3. **CHANNEL SELECTOR:**
Used to select desired channel.
4. **CHANNEL 16 SWITCH:**
In Out position unit will only operate on channel 16.
5. **HI-LOW SWITCH:**
"LOW" position: transmitter is powered at 1 watt level.
"HI" position: transmitter is powered at 25 watts level.
6. **SPEAKER:**
Front panel speaker, no distortion
7. **MICROPHONE JACK:**
Allows microphone plug to be connected.
8. **CHANNEL INDICATOR WINDOW:**
L.E.D. indicator visually shows channel to which set is tuned.
9. **CHANNEL 16 INDICATOR LIGHT:**
Shows when channel 16 button is engaged.
10. **TX INDICATOR LIGHT:**
Lights brightly when transmitting.

REAR PANEL CONNECTORS



There are three jacks on the rear panel of your Model "5000". They are:

- 11. **EXTERNAL SPEAKER JACK:**
Connect external speaker into jack, such as Ray Jefferson RS-109 (8 Ohms).

- 12. **POWER CORD CONNECTOR:**
For use with supplied power cord.
- 13. **ANTENNA CONNECTOR:**
Compatible with Ray Jefferson's recommended VHF/ FM antennas.

INSTALLING YOUR MODEL "5000"

Positioning your Model "5000" is important. Obviously, you want it conveniently located within easy reach and free of interfering objects. At the same time, for top efficiency and protection, you want to shield it from the harmful effects of water and salt spray. The Model "5000" is designed for operation in a marine environment with maximum protection against moisture. However, direct exposure to water or salt spray can be harmful to the equipment.

When installing the Model "5000"

1. Select the driest possible location for installation, maintaining at least a 12-inch clearance from your compass.
2. Decide whether you want an overhead or base mount. The mounting cradle can be installed on either the top or bottom of the radio. To separate the bracket from the radio, unfasten the two side screws.
3. Select the most convenient operating location while observing the precaution in Paragraph 1 above. Leave sufficient space around the radio for adequate ventilation. Fasten the bracket to the area chosen with screws or bolts. Re-install the radio in the bracket.
4. Locate the antenna clear of metal objects and as high as possible, preferably the highest point on the boat. The coaxial feed line should be kept as short as possible consistent with set and antenna location consideration. After installing the antenna, connect the cable to the rear panel antenna connector on the back of the set.

(NOTE: It is suggested you use Ray Jefferson's recommended VHF/FM marine antennas. The Model "5000" has been pre-tuned for operation with these antennas. If any other antenna is used, the services of a licensed radio technician will be required.)

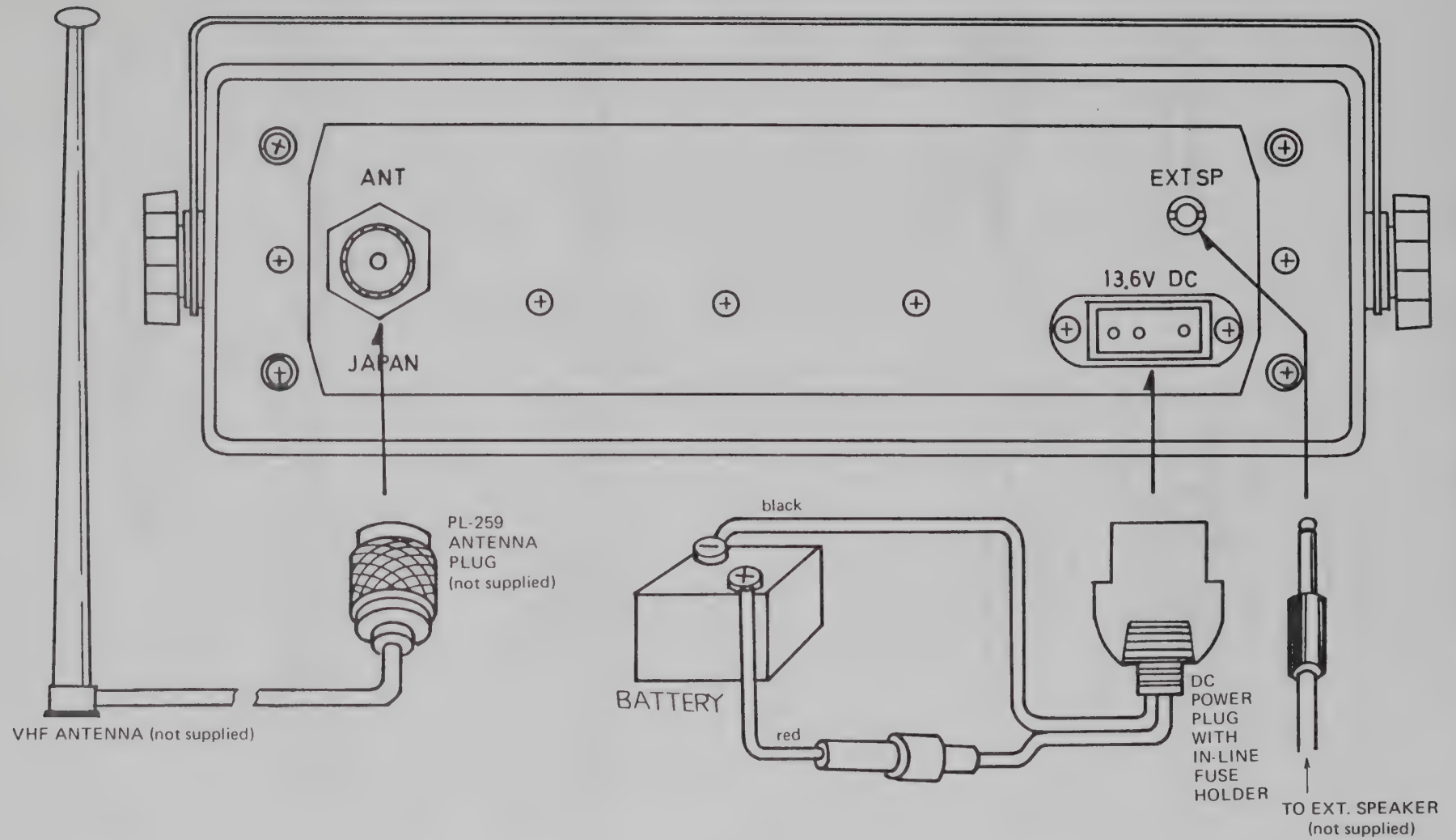
The recommended Ray Jefferson antennas are:

- FG3 (for sailboats) 3 dB gain; 54"
- FG9 6 dB gain; 8'

All antennas come complete with required mounting hardware.

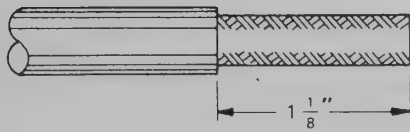
- 5. **POWER CONNECTION:** The Model "5000" is designed to operate from a 12-volt **NEGATIVE GROUND** power source. Do not attempt to use the radio with a positive ground system. Power cable is supplied to make the necessary connections to the boat's battery. It will be necessary to extend the ground wire and the hot wire coming from the power cable connector in order to connect with the storage battery terminals. Use wire no lighter than #12. Connect the ground wire to the negative terminal and the red wire to the positive terminal. The Model "5000" features a safety circuit to prevent transistor burnout. If the unit is incorrectly wired to the power source, an IN-LINE fuse will blow, protecting the unit from further damage. This fuse is easily replaced with one having the same power rating. (7 amp.3AG)

INSTALLATION DIAGRAM

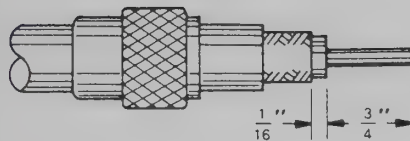


COAX CONNECTOR ASSEMBLY DETAIL

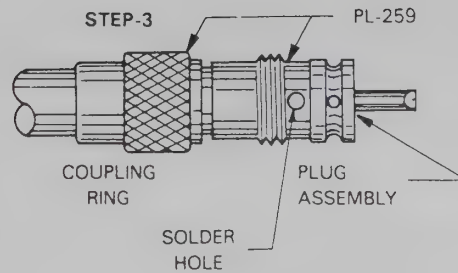
STEP-1



STEP-2

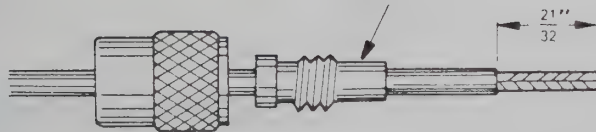


STEP-3

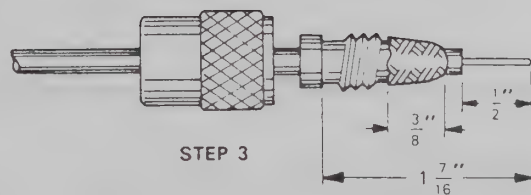


ASSEMBLING ANTENNA PLUG TO RG-8U OR EQUIVALENT.

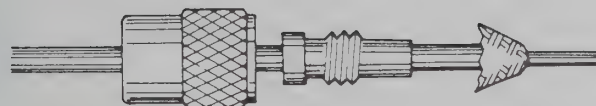
UG-175/U
ADAPTER



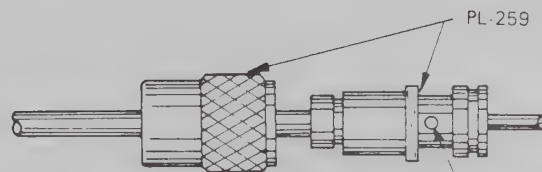
STEP 1



STEP 3



STEP 2



STEP 4

ASSEMBLING ANTENNA PLUG TO RG-58U
OR OTHER 1/4" COAXIAL CABLE

OPERATING YOUR MODEL "5000"

Operation of the Model "5000" is simplicity itself.

To Receive:

1. Rotate the VOLUME CONTROL clockwise a few degrees until the switch snaps into the "ON" position. Advance the VOLUME CONTROL to the desired audio level.
2. Place the SQUELCH CONTROL in the fully counter-clockwise position. Advance the SQUELCH CONTROL clockwise until the background noise on an unoccupied channel is reduced to full quieting. Do not advance the control beyond this point.
3. Select the channel desired with channel selector. If channel 16 is to be used, select with CH.16 button.

To Transmit:

The operation of the transmitter and receiver is controlled by the "Push-to-talk" switch located on the side of the microphone. When depressed, the transmitter is placed into operation and the receiver becomes in-

operative. When released, the receiver is automatically restored to operation and, at the same time, the transmitter becomes inoperative.

1. Place the "HI-LOW" switch in either the "HI" or "LOW" position dependent on the range of desired communications. In the "HI" position, the set operates at full 25 watt power for maximum output. In the "LOW" position, the set operates at one watt of power. Always use "LOW" power on Channel 13.
2. The Red Indicator Lamp will be "ON" whenever the transmitter is activated. However, no transmit on power is radiated from the antenna on channels 1 — 4 and 15.
3. Do not use obscene or profane language when transmitting. To do so is a violation of federal law subject to stiff consequences.

NOTE: Do not attempt to transmit unless your antenna is properly connected.

NOISE SUPPRESSION

While light ignition noise interference is not as bothersome on VHF/FM as it is on other bands, noise suppression should be done even though it does not seem to be bothersome. Noise pulses chop "holes" in the received signal and weaker stations can be completely blanked out. The following procedure for basic noise elimination will also improve reception on other radios and direction finders and provide better operation of all types of depth sounders.

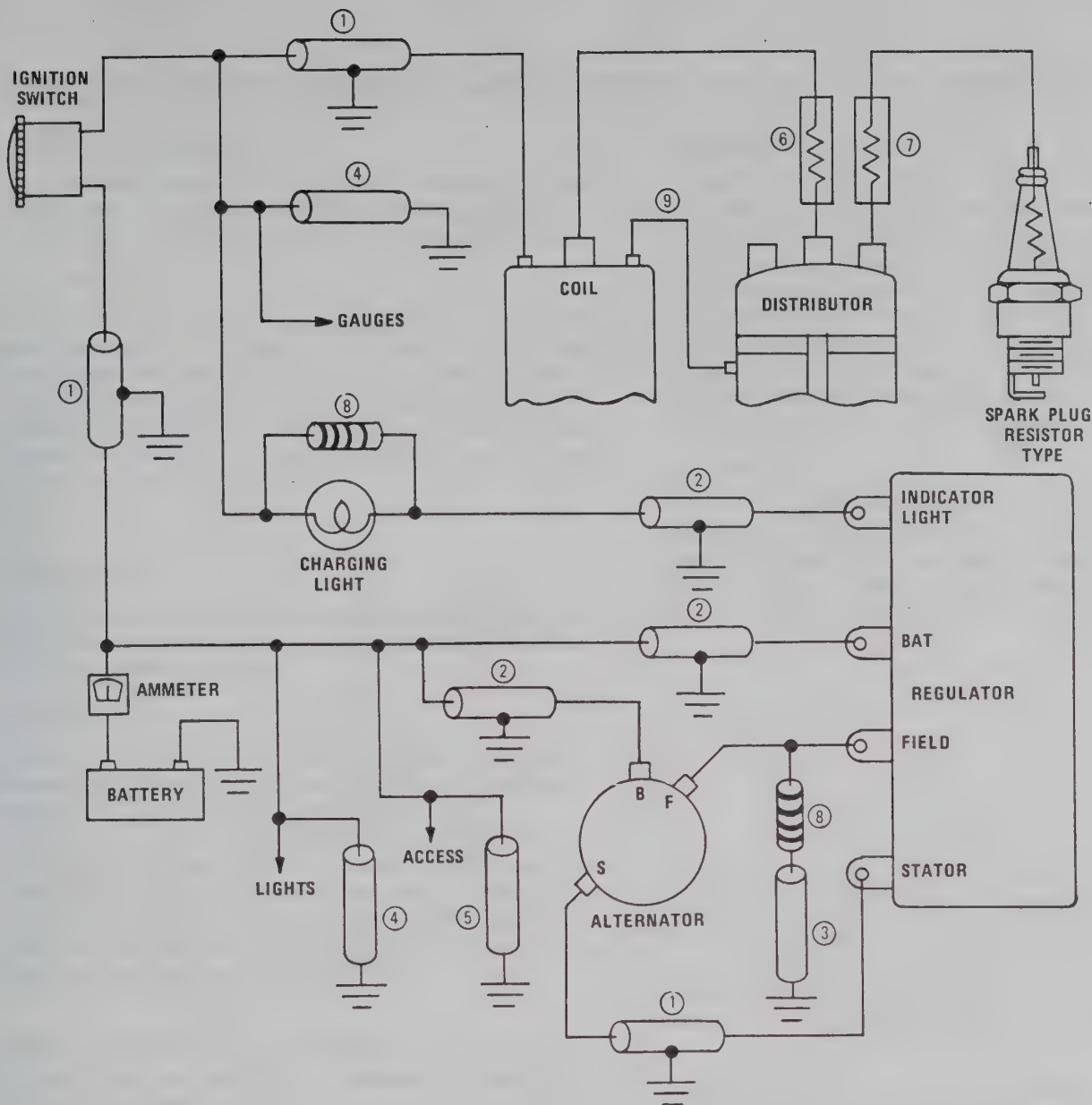
Spark Plugs: On some makes of engines, Champion "U" type spark plugs (such as UJ6) are specified. We have found that it is impossible to eliminate noise caused by these plugs as they have an extra spark gap near the top of plug which causes the leads to radiate this noise. The remedy is to replace these with resistor type plugs, or, better yet, use standard spark plugs with the new MSW cables. This cable looks like ordinary cable, but instead of a solid or carbonized conductor, it consists of a coiled winding of monel wire over a ferrite core which acts as an RF choke reducing the noise to a very low level. As this wire has a very low resistance compared to the usual suppressors, there is no loss in engine performance. These

cables are sold in complete sets packaged for most engines and can be snapped in place in a few minutes.

Ignition Coils: Coils should be mounted on the engine. Clean away paint to insure good ground. Certain coils such as the Mallory plastic encased unit radiate excessive noise and should be replaced with a standard metal case unit.

Voltage Regulators: Older types of regulators contain a vibrating set of contacts to control voltage. If the usual capacitors do not quiet the frying noise, replace with a solid state regulator which has no moving parts.

Tachometers: Some electrical tachometers cause considerable radiation of spark noise. This type of tach connects to the points at the distributor. Disconnect the tach wire at the distributor and note the noise reduction. This lead should be shielded or a special tach filter installed. If Sun tachs are used, all wires must be shielded and the plastic cased sender unit which contains a vibrating set of contacts should be completely shielded in a metal enclosure.



- 1 – CAPACITOR COAXIAL 0.1μ 600 WVDC
- 2 – CAPACITOR COAXIAL $.5\mu\text{F}$ 100 WVDC
- 3 – CAPACITOR $.002\mu\text{F}$ 100 WVDC MICA
- 4 – CAPACITOR $.5\mu\text{F}$ 100 WVDC
- 5 – CAPACITOR $1\mu\text{F}$ 100 WVDC
- 6 – SUPPRESSOR 10K OHM
- 7 – SUPPRESSOR 5K OHM IN EACH SPARK PLUG WIRE OR USE RESISTANCE WIRE.
- 8 – RESISTOR CARBON 4 OHM 2W
- 9 – CAN BE SHIELDED FOR MORE COMPLETE SUPPRESSION.

10 – **CAUTION:** BATTERY, ALTERNATOR, AND REGULATOR CONNECTIONS MAY NOT BE IN THE ORDER INDICATED. CHECK THE REGULATOR TERMINAL LOCATIONS CAREFULLY. DO NOT BYPASS THE FIELD WINDING WITHOUT A RESISTOR IN SERIES WITH THE BYPASS CAPACITOR.

11 – ALL GROUND CONNECTIONS SHOULD BE MADE TO THE COMPONENT BEING BYPASSED. PREFERABLY BY MOUNTING THE SUPPRESSOR DIRECTLY ON THE COMPONENT.

THEORY OF OPERATION

RECEIVER CIRCUIT

Detailed description of the circuits is accomplished by following each block in order. Refer to the block diagram and the circuit diagram for the following circuit descriptions.

RF CIRCUIT:

Signal from the antenna passes through the dual tuned band pass filter and is amplified by Q101, and fed into a triple tuned band pass filter. The signal is then mixed with the signal from Q403 (VCO) by Q102 (first mixer) and produces the first IF (21.4 MHz) signal. This signal passes through crystal filter F101, F102, First IF Amp Q103, and is mixed at Second Mixer in IC101.

AF CIRCUIT:

The AF signal from IC101 is amplified by IC102 to drive the speaker while the receiver is in squelched condition, IC101 is switched by Q105.

IF CIRCUIT:

The output of 1st IF Amp. Q103 is fed into IC101, which contains the second mixer, the second local oscillator, a 455 KHz IF amplifier and a quadrature detector.

A 455 KHz ceramic filter is installed between Pin 3 and Pin 5 of IC101. The detector output is separated into audio and noise components by RC filter. The noise components is fed back into the noise amplifier section of IC101, and its output is rectified by diode D103, D104, and then fed to the switching transistor Q104 and Q105.

PHASE LOCK LOOP (PLL) CIRCUIT

The reference frequency 8 MHz is provided by crystal X401 and transistor Q401. This 8 MHz signal divided by 320 in IC401 to obtain a 25 KHz reference signal, which is applied to phase detector IC404. VCO output from Q403 is fed through amplifier Q404, buffer Q304, Q303 PLL mixer, buffers Q306 and Q307 to IC402.

The signal applied to IC402 is divided by divide ratio N to obtain a 25 KHz signal. N for 1/N divider in IC402 is determined by the micro processor. Both 25 KHz signals are applied to phase detector IC401.

IC401 compares the phase difference between the two signals and generates an error voltage which acts on the VCO to bring the two 25 KHz signals in phase. When this condition occurs, the PLL circuit is locked. The VCO output from Q403 is fed through buffer Q404 and amplifier Q405 to TX mixer Q206 and/or to First RX mixer Q102.

TRANSMITTER CIRCUIT

A signal from the microphone is fed through differential circuit amplifier Q214 – Q215, instantaneous deviation control D205 – D206, amplifier Q212 – Q213, and a low pass filter to modulate diode D203, this controls the frequency of oscillator Q207 to generate a 21.4 MHz FM signal. The 21.4 MHz signal is mixed with the VCO output at mixer Q206. The resultant RF signal from mixer Q206 is amplified by Q204 and Q205, and fed to final amplifier Q201 via predriver Q203 and driver Q202. The RF signal from Q201 is fed to the antenna via a low pass filter.

ALC CIRCUIT

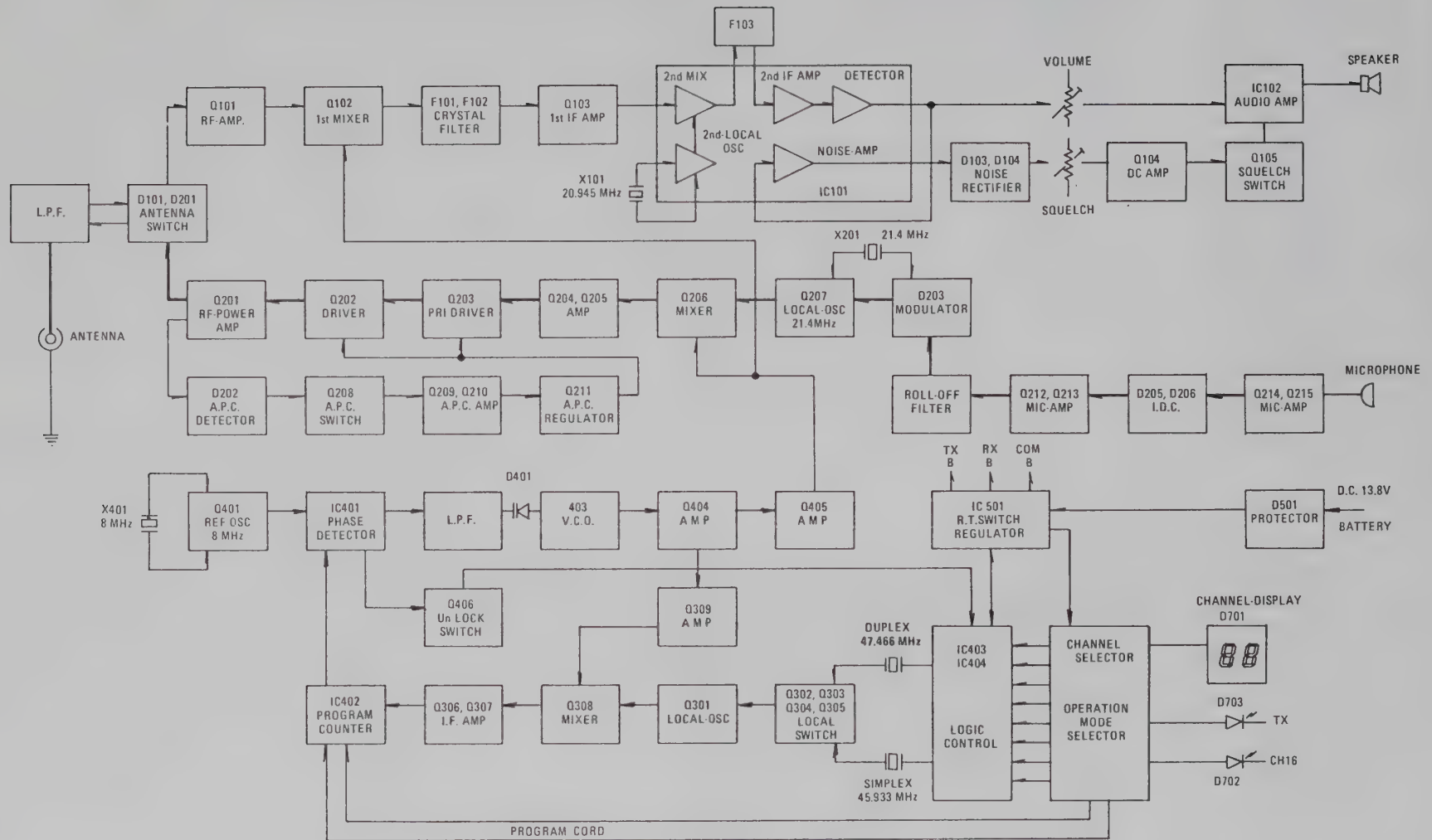
The DC voltage which is proportional to the RF output is detected by D202; this DC voltage is then amplified by Q208, Q209 and Q210. The output voltage from Q211 controls the collector voltage of Q203 and Q202, so the RF output level at Q202 and Q203 is kept at a constant level.

CAUTION

FCC REQUIREMENTS STATE THAT ALL ADJUSTMENTS MADE TO THE TRANSMITTER BE MADE BY A PROPERLY LICENSED AND QUALIFIED TECHNICIAN. THIS INCLUDES INSTALLATION OF TRANSMITTER CRYSTALS AND ANY TUNING THAT IS DONE TO THE TRANSMITTER CIRCUITRY.

PROPER OPERATION OF THE "5000" CALLS FOR A RESONANT 50 OHM ANTENNA. THE INSTALLATION SHOULD BE CHECKED TO SEE THAT THE ANTENNA DOES NOT PRESENT AN APPRECIABLE STANDING WAVE RATIO. IF A HIGH STANDING RATIO EXISTS, CORRECTIVE ACTION MUST BE TAKEN WITH THE ANTENNA. THE TRANSMITTER SHOULD NOT BE RETURNED IN AN ATTEMPT TO CORRECT FOR A FAULTY ANTENNA SYSTEM.

BLOCK DIAGRAM



ALIGNMENT PROCEDURES

GENERAL

THE "5000" HAS BEEN FACTORY ALIGNED USING TECHNIQUES AND TEST EQUIPMENT NOT NORMALLY AVAILABLE TO THE SERVICE TECHNICIAN. IT SHOULD NOT BE NECESSARY TO PERFORM ANY ALIGNMENT ON THE UNIT AS RECEIVED FROM THE FACTORY. IN THE EVENT OF COMPONENT

FAILURE, ANY REALIGNMENT WILL BE MINIMAL. IF IT APPEARS THAT ANY LARGE DEGREE OF REALIGNMENT IS REQUIRED, THOROUGHLY CHECK THE REPLACEMENT COMPONENT BEFORE PROCEEDING.

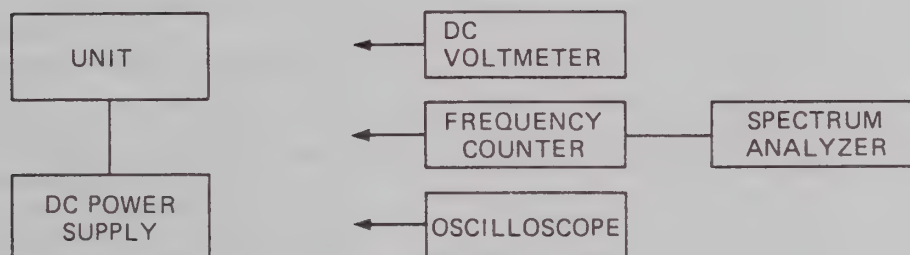
1. EQUIPMENT REQUIRED:

- Spectrum Analyzer
- Frequency Counter (200 MHz)
- DC Voltmeter
- Distortion Meter
- RF Power Meter (30W)
- FM Linear Detector
- Audio Generator
- 8 ohm Dummy Load
- Oscilloscope
- AF VTVM
- Signal Generator 150 – 200 MHz

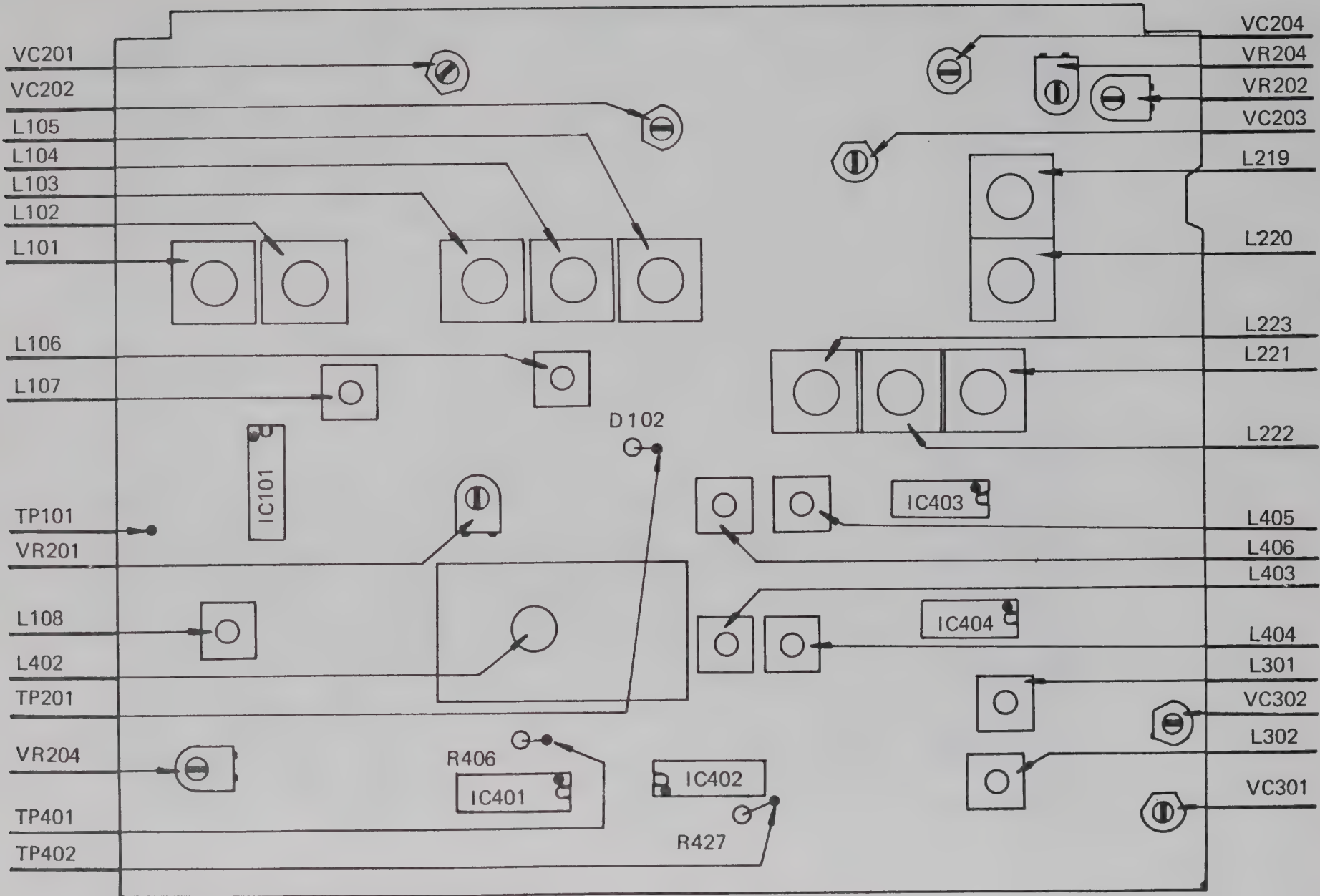
2. PLL CIRCUIT

- Connect the spectrum analyzer and frequency counter to TP201.
- Connect an oscilloscope to TP402.
- Connect a DC voltmeter to TP401.

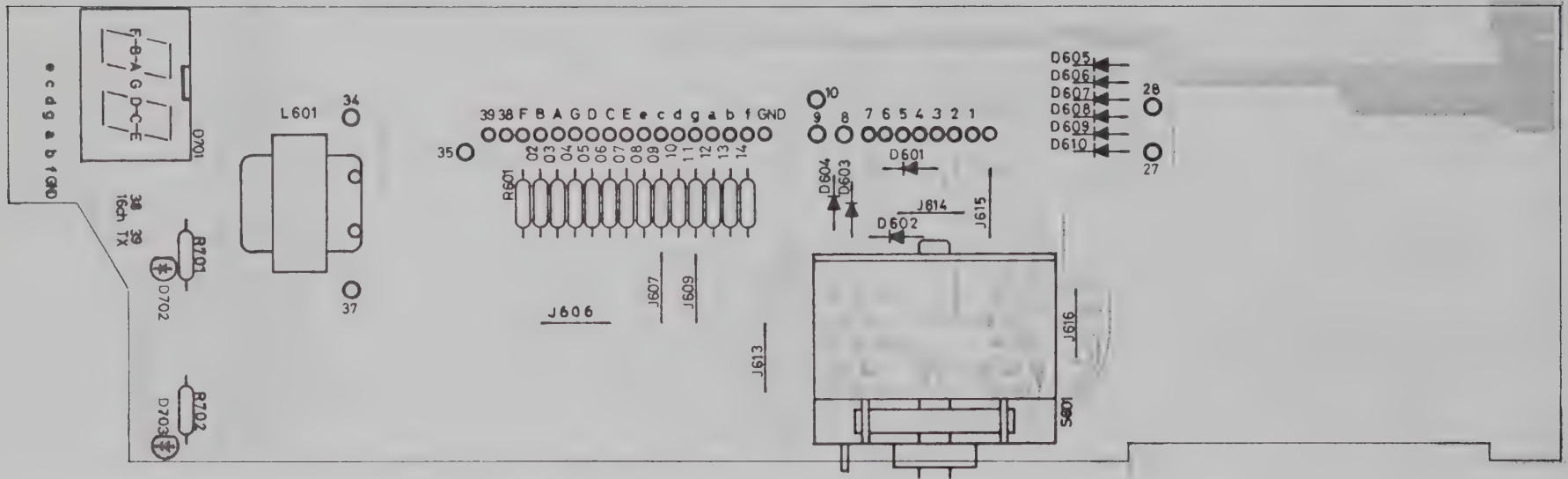
- Select Channel 16. Rotate L402 CCW from bottom to top and adjust it for a 3 volt reading on the DC voltmeter at the first lock.
- Adjust L403, L404, L301 and L302 for a 4 VP-P reading on the oscilloscope.
- Adjust L405, L406 and L404 to obtain the same oscillation level on the spectrum analyzer on Channels 16 and 28.
- Select Channel 16. Adjust VC301 for a reading of 135.4 MHz on the frequency counter.
- Select Channel 28. Adjust VC302 for a reading of 140.0 MHz on the frequency counter.
- Adjust L301, L302 until the shape of the wave form distorts during reduction.
- Check that the PLL is locked on all channels and have a 4 VP-P reading on the oscilloscope.
- Select Channel 5. Set the power supply to 10 volts and make sure the PLL is locked.



ALIGNMENT LOCATIONS



SWITCH P.C. BOARD (TOP VIEW)



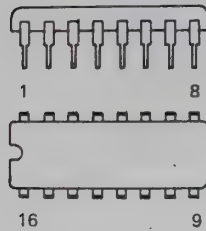
SEMICONDUCTORS VOLTAGE CHART

SYMBOL No.	BASE (GATE I)V	COLLEC-TOR (DRAIN)V	EMITTER (SOURCE)V	(GATE II)V	DESCRIPTIONS	SYMBOL No.	BASE (GATE I)V	COLLEC-TOR (DRAIN)V	EMITTER (SOURCE)V	(GATE II)V	DESCRIPTIONS
Q101	0	7.6	0.5	3.6	FET	Q213	0.6	2.6	0		
Q102	0	7.6	0.1	0	FET	Q214	4.4	5.0	3.8		
Q103	1.4	7.6	0.8			Q215	0.6	1.2	0		
Q104	0	6.8	0			Q301	1.2	3.6	0.7		
	0.6	0.8	0		SQUELCHED	Q302	2.5	1.6	—		SIMPLEX
Q105	8.0	8.0	0				2.5	2.6	—		DUPLEX
	7.3	8.0	6.6		SQUELCHED	Q303	2.5	7.2	—		SIMPLEX
Q201	0	13.5	0				2.5	1.6	—		DUPLEX
Q202	0	8.0	0		HIGH-POWER	Q304	0.6	0	0		SIMPLEX
	0	6.0	0				0	2.5	0		DUPLEX
Q203	0.5	8.0	0		HIGH-POWER		0	7.2	0		SIMPLEX
	0.3	6.0	0			Q305	0.6	0	0		DUPLEX
Q204	1.2	8.0	0.6			Q306	0.6	2.6	0		
Q205	2.2	7.3	1.5			Q307	1.2	1.5	0.7		
Q206	1.8	8.0	1.2			Q308	0.8	6.0	0.2		
Q207	1.6	7.5	1.0			Q309	1.4	6.8	0.8		
Q208	0.6	4.0	0		HIGH-POWER	Q401	3.2	8.0	4.0		
	0.6	2.0	0			Q402	0.6	0	0		SIMPLEX
Q209	4.0	12.0	3.2		HIGH-POWER		0	0	0		DUPLEX
	2.0	13.0	1.8			Q403	3.0	5.0	2.5		
Q210	12.0	6.0	13.5		HIGH-POWER	Q404	1.4	6.7	0.6		
	13.0	3.2	13.8			Q405	0	6.0	0.4	3.0	FET
Q211	6.0	13.5	6.0		HIGH-POWER		8.0	0	0.5		
	3.2	13.8	2.6			Q406	0	0	8.0		UN-LOCK
Q212	4.0	6.0	3.4								

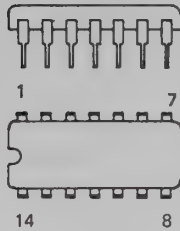
SYMBOL No.	1 V	2 V	3 V	4 V	5 V	6 V	7 V	8 V	9 V	10 V	11 V	12 V	13 V	14 V	15 V	16 V	DESCRIPTIONS
IC101	6.8	6.2	6.6	7.0	1.0	1.0	1.0	7.0	3.2	1.8	2.0	—	—	—	0	1.8	
IC102	—	13.8	3.4	0	1.2	1.2	13.0	0	—	6.6							SQUELCHED
	—	13.8	3.4	0	2.0	2.0	13.0	0	—	0.3							
IC401	—	0	0	0	8.0	0	8.0	0	4.0	8.0	0	8.0	3.0	0	8.0	8.0	CHANNEL 16
IC402	0	0	0	0	0	0	8.0	0	4.0	0	0	6.0	6.0	0	—	—	CHANNEL 16
IC403	7.2	7.2	0	8.0	0	6.0	0	8.0	8.0	0	8.0	0.5	0.5	8.0	—	—	RECEIVER
	0	0	8.0	0	8.0	6.0	0	0	0	8.0	0	8.0	8.0	8.0	—	—	TRANSMITTER
IC404	—	—	—	0	6.0	6.0	0	0.5	0.5	7.4	0	7.4	7.4	8.0	—	—	SIMPLEX
	—	—	—	8.0	0	0	0	6.2	6.2	0	7.6	0	0	8.0	—	—	DUPLEX
IC501	8.0	13.8	8.0	0	8.0	8.0	0	0									RECEIVER
	8.0	13.5	8.0	0	0	0	0	8.0									TRANSMITTER

SEMICONDUCTORS PIN CONFIGURATION

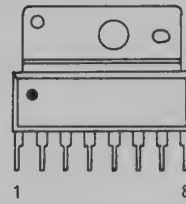
MC3357P
MC14568
MC14569



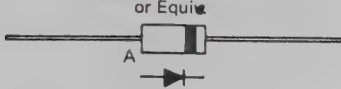
MC14011
or Equivalent



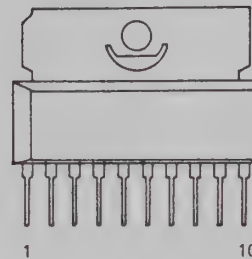
MB3756



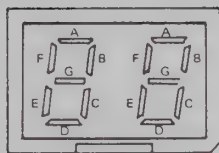
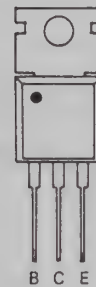
IS1588
GP25
1K60
MC301
MI301
MI401
or Equivalent



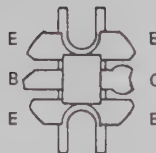
M51514AL



2SC880 or Equiv.



TLR320



2SC1946A
2SC2237

3SK598L or Equiv.



2SC2053



2SC2668Y or Equiv.



2SC710C or Equiv.



2SA999E
2SC2320E
2SC1923Y or Equiv.



FC52M



TLG124
TLR124



REPLACEMENT PARTS LIST

Circuit Symbol	Description	Part No.	Circuit Symbol	Description	Part No.
IC101	Integrated Circuit MC3357P		L306	Inductor LF4-2R2K	
IC102	Integrated Circuit M51514AL		L601	Choke trans.	PU-158
IC401	Integrated Circuit MC14568BP		L210	Choke coil	C-026
IC402	Integrated Circuit MC14569BP		L218, 224	Choke coil	C-025
IC403, 404, 602	Integrated Circuit TC4011 or equiv.		L225	Choke coil	C-024
IC501	Integrated Circuit MB3756		L226	Choke coil	C-023
			L303	Choke coil	C-022
			L304	Choke coil	C-021
			L201, 202, 205, 206	Coil	C-030
			L203, 209, 215, 216	Coil	C-029
			L204	Coil	C-027
			L207	Coil	C-033
			L208, 214	Coil	C-032
			L211, 212	Coil	
			L213, 217	Coil	C-028
Q101, 102, 405	Field effected transistor 3SK59BL		FC201	Forritre core BF-07	PU-169
Q306, 307, 401	Transistor 2SC710C or equiv.		C101	Ceramic capacitor 33PF RH	
Q104, 208, 209, 212, 213, 214, 215, 304, 305,	Transistor 2SC2320E or equiv.		C102, 227, 236, 238, 436, 428	Ceramic capacitor 10PF RH	
Q105, 210, 406	Transistor 2SA999E or equiv.		C103, 303, 432, 437	Ceramic capacitor 1PF SL	
Q201	Transistor 2SC1946A		C104	Ceramic Capacitor 2PH RH	
Q202	Transistor 2SC2237		C105, 106, 115, 207, 214, 218, 223, 224, 225, 253, 306, 310, 312, 315	Ceramic capacitor 0.0047μFD	
Q203	Transistor 2SC2053 or equiv.		C107, 114, 132, 142, 147, 203, 232, 243, 251, 252, 254, 259, 260, 271, 273, 274, 317, 416, 281, 441	Ceramic capacitor 0.001μF B	
Q204, 205	Transistor 2SC2347 or equiv.		C108, 241, 229	Ceramic capacitor 7PF RH	
Q206, 207, 308, 309, 404	Transistor 2SC1923OR or equiv.		C109, 116, 118, 119, 120, 204, 230, 233, 239, 242, 244, 247, 278, 279, 304, 309, 314, 316, 318, 319, 320, 323, 324, 406, 407, 412, 413, 414, 421, 423, 426, 427, 433, 434, 435, 440, 506,	Ceramic capacitor 0.01μF F	
Q211	Transistor 2SD880 or equiv.		C110, 112, 209, 228	Ceramic capacitor 0.5PF SL	
Q301, 302, 303, 402, 403, 103	Transistor 2SC2668Y or equiv.		C111	Ceramic capacitor 9PF RH	
			C113	Ceramic capacitor 3PF RH	
D101	Si diode MI301		C117	Ceramic capacitor 15PF CH	
D102	Si diode MC301		C122, 307	Ceramic capacitor 47PF UJ	
D103, 104, 202	Ge diode 1K60 or equiv.		C123, 249	Ceramic capacitor 100PF UJ	
D105, 106, 204, 205, 206, 402, 403, 404, 405, 406, 407, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610	Si diode IS1588 or equiv.		C124, 409, 411	Ceramic capacitor 100PF SL	
D201	Si diode MI402		C127, 418, 422, 424, 431,	Ceramic capacitor 10PF CH	
D203	Si diode FC52M		C129	Ceramic capacitor 22PF SL	
D401	Si diode MV201		C130, 131	Ceramic capacitor 330PF B	
D501	Si diode GP25B or equiv.		C201, 216	Ceramic capacitor 12PF CH	
D701	LED TLR320		C202, 205, 210, 213, 215, 221, 220, 245, 277	Ceramic capacitor 22PF CH	
D703	LED TLR124		C206, 208, 211	Ceramic capacitor 39PF CH	
D702	LED TLG124A		C219, 420	Ceramic capacitor 5PF CH	
F101, 102	Crystal filter MT21RB	PU-165	C226	Ceramic capacitor 47PF RH	
F103	Ceramic filter LF-B15	PU-166	C305	Ceramic capacitor 6PF RH	
X101	Crystal 20.945 MHz	X-8	C231, 246, 325	Ceramic capacitor 100PF CH	
X201	Crystal 21.400 MHz	X-9	C235, 301,	Ceramic capacitor 22PF RH	
X301	Crystal 45.933 MHz	X-10	C237, 240	Ceramic capacitor 0.33PF SL	PU-154
X302	Crystal 47.466 MHz	X-11	C248, 308, 403	Ceramic capacitor 220PF UJ	
X401	Crystal 8.000 MHz	X-7	C250	Ceramic capacitor 12PF UJ	
L101, 102, 103, 104, 105, 219, 220, 221, 222, 223, 402	RE Coil E502HN 3000023	R-020	C256, 257	Ceramic capacitor 470PF B	
L106	IFT 21.4 MHz	I-014	C258	Ceramic capacitor 330PF SL	
L107	IFT 21.4 MHz	I-013	C302	Ceramic capacitor 18PF RH	
L108	AM. IFT	I-003	C311	Ceramic capacitor 10PF UJ	
L301, 302, 403, 404, 405, 406	RE Coil 140 MHz	R-019	C322, 419, 425, 429, C401, 404	Ceramic capacitor 2PF CH	
			C402	Ceramic capacitor 33PF CH	
			C417	Ceramic capacitor 120PF UJ	
			C430	Ceramic capacitor 8PF CH	
			C438	Ceramic capacitor 8PH RH	
L227, 401	Inductor LF1-471K			Ceramic capacitor 12PF RH	
L228	Inductor LF5-273K				
L305	Inductor LF1-470K		C125, 126, 128, 262	Film capacitor 0.047μF K	

Circuit Symbol	Description	Part No.	Circuit Symbol	Description	Part No.
C135	Film capacitor 0.1 μ F K		R425	Carbon resistor 47 ohm	
C139	Film capacitor 0.022 μ F K		R601, 602, 603, 604, 605	Carbon resistor 1k ohm	
C140, 276	Film capacitor 0.01 μ F K		606, 607		
C145	Film capacitor 0.22 μ F K		608, 610, 612, 614, 611		
			609, 613		
C121	Tantalum capacitor 10 μ F 16V		R701	Carbon resistor 680 ohm	
			R702	Carbon resistor 1.5k ohm	
C133, 134, 261	Electrolytic capacitor 0.1 μ F 50V				
C136, 137, 266	Electrolytic capacitor 0.47 μ F 50V		VC201, 202, 203, 204, 301 302	Trimmer capacitor CTZ-51E	PU-176
C141, 212, 217, 222	Electrolytic capacitor				
265, 269, 321, 415, 605	10 μ F 16V		VR101	Volume 5M 1111 ~ 10KA	PU-153
609			VR102	Volume VM10A741E-20KB	PU-152
C143, 234, 501	Electrolytic capacitor 100 μ F 16V		VR201, 202	Trimmer-resistor 50k ohm	PU-164
			VR203	Trimmer-resistor 5k ohm	PU-163
C144, 146, 270	Electrolytic capacitor 47 μ F 16V		VR204	Trimmer-resistor 2k ohm	PU-162
C255	Electrolytic capacitor 33 μ F 16V		S601	Rotary switch PSS35 (50)	PU-151
C263, 410	Electrolytic capacitor 0.22 μ F 50V			P.C. Board main	Z-56
C264	Electrolytic capacitor 4.7 μ F 25V			P.C. Board switch	Z-47
C267, 268, 272, 275, 439	Electrolytic capacitor				
502, 138	1 μ F 50V				
C405	Electrolytic capacitor 220 μ F 16V	J001		Antenna connector MRM2	PU-155
		J002		Earphone jack	PU-72
C408	Electrolytic capacitor 2.2 μ F 25V	J003		Mike connector SM144S	PU-71
		J004		Receptacle B9416	PU-142
C503, 504	Electrolytic capacitor 330 μ F 16V			DC power cord	PU-168
				Push switch	PU-156
C505	Electrolytic capacitor 1000 μ F 16V		S002, 602	Speaker	PU-154
RA401	Resistor Arry 473-8			Microphone	PU-157
R101, 102, 114, 118, 122	Carbon resistor 22k ohm			Front panel	M-49
234, 235, 309, 311, 312				Optical filter	Z-45
322, 419, 423, 424				Case	M-51
R103, 104, 107, 209, 213	Carbon resistor 100 ohm			Chassis left side	N-48
301, 416				Chassis right side	N-47
R105, 223	Carbon resistor 68k ohm			Chassis rear	N-45
R106, 206	Carbon resistor 22 ohm			Heat sink	N-44
R108, 115, 116, 120, 216	Carbon resistor 2.2k ohm			Shield case	N-50
225, 232, 236, 238, 240				Shield plate	N-49
242, 302, 305, 307, 308				Bracket speaker	N-18
316, 410					
R109, 111, 123, 214, 219	Carbon resistor 1k ohm				
230, 243, 306, 320, 324					
325, 421, 403				Rubber foot	G-18
R110	Carbon resistor 820k ohm			Knob volume	M-46
R112, 113, 202, 217, 303	Carbon resistor 220 ohm			Mounting bracket	N-51
323, 408, 412, 426				Rubber washer	G-21
R117, 125, 422, 429, 430	Carbon resistor 47k ohm			Screw mounting	PU-145
432, 434, 435, 431, 433				Name plate (Model)	H-9
R119	Carbon resistor 680k ohm			Name plate (Brand)	H-10
R121, 127, 201, 215, 401	Carbon resistor 10k ohm				
411				Knob channel	M-45
R124, 205, 212, 213	Carbon resistor 3.3k ohm			Knob spring	PU-146
R126, 239, 241, 304, 404	Carbon resistor 100k ohm				
405, 427, 428					
R128, 220, 310, 402, 406	Carbon resistor 15k ohm				
R203	Carbon resistor 10 ohm				
R204, 210, 218, 229, 237	Carbon resistor 330 ohm				
315, 317, 420					
R207	Carbon resistor 1.8k ohm				
R208, 211, 319, 414	Carbon resistor 6.8k ohm				
R221, 415, 418	Carbon resistor 4.7 k ohm				
R222	Carbon resistor 5.6k ohm				
R226, 227	Carbon resistor 470 ohm				
R228	Carbon resistor 270 ohm				
R231	Carbon resistor 150k ohm				
R233, 318	Carbon resistor 330k ohm				
R314	Carbon resistor 180k ohm				
R321	Carbon resistor 2.7k ohm				
R326	Carbon resistor 560k ohm				
R407	Carbon resistor 390 ohm				
R409	Carbon resistor 33k ohm				
R413, 417	Carbon resistor 1.5k ohm				

MODEL "5000" MARINE CHANNELS AND THEIR USAGE

CAUTION: While it is possible to select channel such as channels 1 ~ 4 and 15, the transmitter is disabled since no communication is authorized on these channels.

CHANNEL DESIG	FREQUENCY (MHz)		TYPE TRAFFIC	FUNCTION	
	TX	RX		SHIP TO SHIP	SHIP TO SHORE
1	—	162.550	ESSA Weth	Receive Only	Receive Only
2	—	162.400	ESSA Weth	Receive Only	Receive Only
3	—	162.475	ESSA Weth	Receive Only	Receive Only
4	—	161.650	Canadian Weth	Receive Only	Receive Only
05 (A)	156.250	156.250	Port Op	Yes	Yes
06	156.300	156.300	Safety	Yes	No
07 (A)	156.350	156.350	Com'l	Yes	Yes
08	156.400	156.400	Com'l	Yes	No
09	156.450	156.450	Com'l & Non Com'l	Yes	Yes
10	156.500	156.500	Com'l	Yes	Yes
11	156.550	156.550	Com'l	Yes	Yes
12	156.600	156.600	Port Op	Yes	Yes
13	156.650	156.650	Nav.	Yes	Yes
14	156.700	156.700	Port Op	Yes	Yes
15	—	156.750	Distress, Safety C	Receive Only	Receive Only
16	156.800	156.800	Safety C	Yes	Yes
17	156.850	156.850	State Con	Yes	Yes
18 (A)	156.900	156.900	Com'l	Yes	Yes
19 (A)	156.950	156.950	Com'l	Yes	Yes
20	157.000	157.000	Port Op	Yes	Yes
21 (CG)	157.050	157.050	Coast Ga'd	Yes	Yes
22 (CG)	157.100	157.100	Coast Ga'd	Yes	Yes
23 (CG)	157.150	157.150	Coast Ga'd	Yes	Yes
24	157.200	161.800	Public C	No	Yes
25	157.250	161.850	Public C	No	Yes
26	157.300	161.900	Public C	No	Yes
27	157.350	161.950	Public C	No	Yes
28	157.400	162.000	Public C	No	Yes
65 (A)	156.275	156.275	Port Op	Yes	Yes
66 (A)	156.325	156.325	Port Op	Yes	Yes
67	156.375	156.375	Com'l	Yes	No
68	156.425	156.425	Non Com'l	Yes	Yes
69	156.475	156.475	Non Com'l	Yes	Yes
70	156.525	156.525	Non Com'l	Yes	No
71	156.575	156.575	Non Com'l	Yes	Yes
72	156.625	156.625	Non Com'l	Yes	No
73	156.675	156.675	Port Op	Yes	Yes
74	156.725	156.725	Port Op	Yes	Yes
77	156.875	156.875	Port Op	Yes	No
78 (A)	156.925	156.925	Non Com'l	Yes	Yes
79 (A)	156.975	156.975	Com'l	Yes	Yes
80	157.025	157.025	Com'l	Yes	Yes
81	157.075	157.075	Coast Ga'd	Yes	Yes
82 (CG)	157.125	157.125	Coast Ga'd	Yes	Yes
83 (CG)	157.175	157.175	Coast Ga'd A	Yes	Yes
84	157.225	161.825	Public C	No	Yes
85	157.275	161.875	Public C	No	Yes
86	157.325	161.925	Public C	No	Yes
87	157.375	161.975	Public C	No	Yes
88 (A)	157.425	157.425	Com'l	Yes	No

CAUTION: OPERATION OF CHANNELS NOT DESIGNATED FOR USES BY YOUR CLASSIFICATION OF CRAFT OR ON INTERNATIONAL CHANNELS WHEN WITHIN UNITED STATES TERRITORIAL WATERS IS A VIOLATION OF FEDERAL COMMUNICATIONS COMMISSION RULES AND REGULATIONS AND MAY RESULT IN SEVERE PENALTIES.

